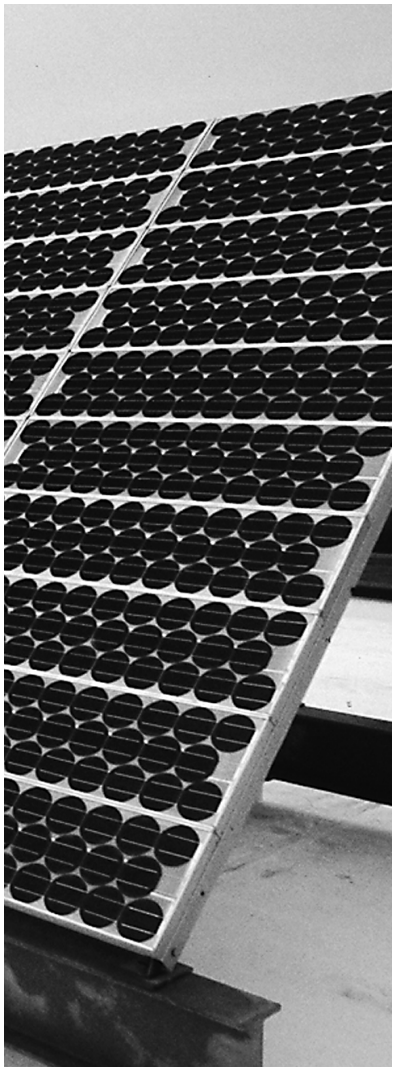
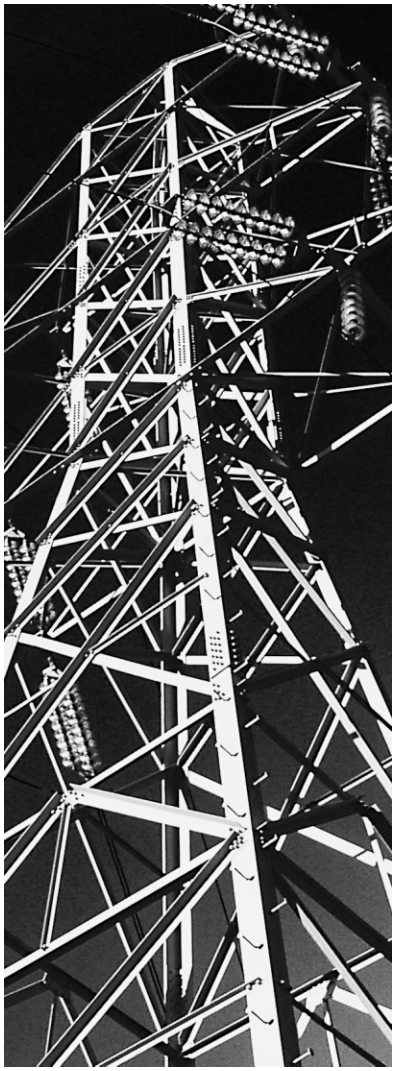
Transmission Planning Through a Wide-Angle Lens

A Two-Year Report on BPA's Non-Wires Solutions Initiative

September 2004





The Bonneville Power Administration has embarked on a new era in transmission planning. As plans take shape to address load growth, constraints and congestion on the transmission system, BPA is considering measures other than building new lines, while maintaining it's commitment to provide reliable transmission service. The agency, along with others in the region, is exploring "non-wires solutions" as a way to defer large construction projects.

BPA defines non-wires solutions as the broad array of alternatives, including but not limited to demand response, distributed generation, conservation measures, generation siting and pricing strategies that individually or in combination delay or eliminate the need for upgrades to the transmission system. The industry also refers to non-wires solutions as non-construction alternatives or options.

This report summarizes two years' worth of effort to investigate non-wires solutions. In particular, it focuses on the activities of a regional round table that has tackled issues surrounding non-wires solutions with creativity and enthusiasm. The round table's work is already being reflected as the Transmission Business Line plans for major transmission upgrades.

Background

The Bonneville Power Administration owns and operates 75 percent of the Pacific Northwest's electrical transmission system, a system that includes more than 15,000 miles of high-voltage transmission line and 285 substations. At peak usage, the system transports about 30,000 megawatts (MW) of electricity to customers in Oregon, Washington, Idaho and Montana, as well as to parts of Wyoming, Nevada, Utah and California. The BPA system, along with the high-voltage lines of other public and private utilities, is referred to collectively as "the transmission grid."

BPA did not undertake any substantial transmission construction between 1987 and 2003. Over that period, TBL upgraded communications and control systems, installed equipment for voltage support and made other technical fixes to strengthen the Northwest's transmission grid in areas where there were problems. Since 1999, the system has operated at or near capacity to meet demand. Some areas on the system are more congested than others, particularly at times when loads or transfers are heavy.

In 2001, TBL developed a transmission infrastructure program focused on reinforcing the existing transmission grid, especially in Washington; addressing constrained and congested areas; and providing for load growth.

Transmission Planning

BPA is dedicated to assuring that it finds the most cost-effective solutions to reliably meet the region's transmission needs. Before the agency decides to build a line, it will make sure to consider whether non-wires solutions can address the problem. BPA's non-wires initiative was created to look at all options, not just traditional construction, in an effort to make exploration of non-wires solutions an official and bona fide element in BPA's transmission planning.

Of 20 problem areas identified on the grid, nine projects were designated as top priorities.

BPA has aggressively pursued conservation and energy efficiency for over 20 years. The idea of targeting these activities to defer constructing transmission lines first stirred the interest of planners in the late 1980s, when BPA was contemplating a cross-Cascade 500-kV line. Instead of the line, a new substation was built, voltage-support devices were installed and the Puget Sound area was targeted for conservation.

As plans for the infrastructure projects were taking shape in 2001, TBL began to consider a wider-angle approach to planning, one that included non-wires solutions. If a reliable and cost-effective non-wires solution could be found, it was worth considering.

TBL subsequently commissioned an in-depth study of its transmission planning process with an eye toward incorporating non-wires solutions. The consultants who conducted the study reviewed the existing procedures and identified improvements to ensure that options other than transmission line construction were considered appropriately and early enough to be used to address problems. The consultants also pointed out which of the problem areas on the transmission grid might be solved with a non-wires solution.

The consultants' November 2001 study, entitled *Expansion of BPA Transmission Planning Capabilities: A Report on Non-Transmission Alternatives,* offered a number of recommendations and alternatives for improving the transmission planning process. And it provided a model for determining when non-wires solutions were cheaper than immediate construction of a new transmission facility. As a result, for example, load management is effective at shaving perhaps a 40-hour peak on an extreme cold winter day to meet reliability criteria, deferring the need for a new line. The savings available through deferring a multi-million dollar capital expenditure project for several years can be substantial. The study strengthened TBL's commitment to incorporate non-wires solutions as an integral part of planning for transmission.

In 2002, BPA announced its Non-Wires Solutions initiative and laid out the following goals. To identify and investigate:

- Least-cost solutions that may result in deferring potential transmission reinforcement projects;
- Ways to incorporate the planning methodology proposed in the study into the transmission planning process;
- Opportunities for and potential constraints on integrating non-wires solutions into the transmission system;

Building for Reliability

The nine-mile 500-kilovolt (kV) Kangley-Echo Lake line in the Puget Sound area was energized Dec. 31, 2003. It is the first major addition to BPA's high-voltage transmission system since 1987. In April 2003, BPA began work on the 84-mile Grand Coulee-Bell line in northeastern Washington. Grand Coulee-Bell will replace a 115-kV wood-pole line with a 500-kV steel lattice-tower line. It is scheduled for completion in December 2004.

- A set of criteria to help determine when non-wires solutions are feasible and when they are not, including developing a set of screening tools for future non-wires candidates; and
- Ways to integrate the work from this effort sufficiently early in the planning process so that non-wires solutions can make a difference.

The initiative included forming a round table, screening transmission projects for their potential as candidates for non-wires solutions, preparing a biennial system-wide report that looks 10 years into the future, conducting non-wires pilot projects and preparing a programmatic environmental impact statement (EIS) for transmission policy issues.

The Non-Wires Solutions Round Table

One of the key recommendations in the 2001 consultants' study was to enhance the transmission planning process by gathering insights and feedback from experts and interest groups in the region. BPA followed up on that suggestion by forming the Non-Wires Solutions Round Table, which met for the first time in January 2003.

BPA formed the round table to gain a region-wide perspective on non-wires solutions. Specifically, BPA wanted a broader discussion of the issues involved and an opportunity to build understanding around the Northwest about the overall goals of the non-wires solutions initiative. In addition, BPA wanted the round table to assist in expanding consideration of non-wires solutions, keeping system reliability in mind, as it proceeded with planning for a number of major transmission upgrades.

The 17 members of the round table from outside BPA represent a diverse cross-section of interests in the region, including public and private utilities, environmental groups, regulators, large energy users, an organization of Indian tribes, renewable resource advocates and independent power generators (see the list of round table members and their affiliations on page 4). Members accepted the invitation to participate with the understanding that their charge is to offer insights and perspectives on key questions and to ensure balance in BPA's transmission planning process.

The round table tackled four major groups of issues in 2003: screening criteria; detailed studies for particular problem areas on BPA's transmission system; non-wires technology and institutional barriers. They formed 11 subcommittees to explore various aspects of these issues and prepare reports to present to the full group.

Screening criteria: BPA and its consultants developed a way to easily evaluate a transmission problem area to see if it is a candidate for a non-wires solution. They considered how such screening should take place – the appropriate questions and the criteria for determining the candidates – and developed a screening checklist. The round table made recommendations to improve the screening tool.

As a result of the round table's work, BPA has reconfigured its transmission planning process to include an initial screening of projects to assess their potential for a non-wires solution. BPA is now committed to using non-wires solutions screening criteria for all capital transmission projects over $2 million so it becomes an institutionalized part of planning. The steps in the new transmission planning process are illustrated in the diagram on page 5.

An initial screening determines whether a project presents the opportunity to explore a non-wires solution. If so, TBL continues with a detailed analysis of the non-wires potential.

Detailed Studies: TBL prepared a more detailed analysis of the potential to cost-effectively defer transmission upgrades in an environmental impact statement for the Kangley-Echo Lake (Puget Sound area) project. Because the amount of load reduction needed was so large in the Puget Sound area and the proposed line would reduce transmission energy losses by 5.5 average MW annually,

Non-Wires Round Table Members

Brian Silverstein, Co-chair
Acting Vice President, Transmission Planning, Bonneville Power Administration

Carolyn Whitney, Co-chair
Vice President of Business Line Management & Services, Bonneville Power Administration

Ken Canon
Executive Director, Industrial Customers of Northwest Utilities

Ralph Cavanagh
Co-Director, Energy Program, Natural Resources Defense Council

Art Compton
Administrator, Planning, Prevention and Assistance Division, Montana Department of Environmental Quality

Tom Foley
Consultant, Energy and Environmental Economics, Non-Wires Study

Nancy Hirsh
Policy Director, Northwest Energy Coalition

Hardev Juj
Director, Transmission and Distribution Planning, Seattle City Light

Robert Kahn
Executive Director, Northwest Independent Power Producers Coalition

Tom Karier
Council Member, Northwest Power Planning Council, Washington State

Paul Kjellander
President, Idaho Public Utilities Commission

Steve LaFond
Energy Resources Utilities Management, The Boeing Company

Sue McLain
Senior Vice President of Operations, Puget Sound Energy

Kris Mikkelsen
Chief Executive Officer, Inland Power & Light Company

Bill Pascoe
Consultant, Pascoe Energy

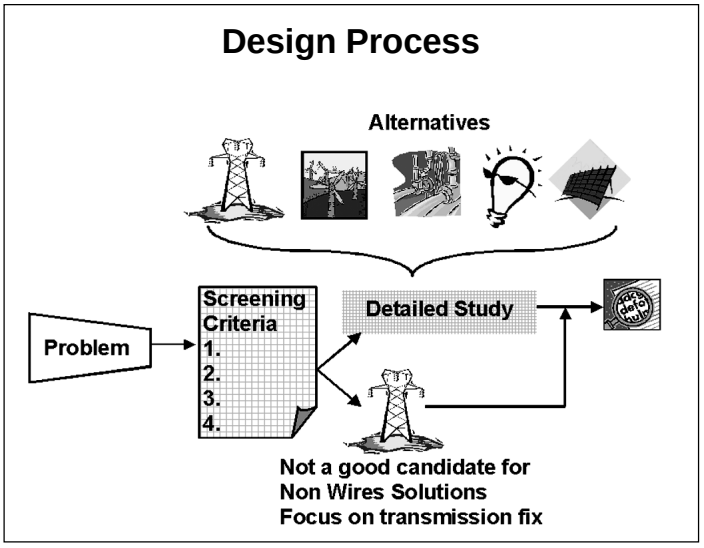
Heather Rhoads-Weaver
Executive Director, Northwest Sustainable Energy for Economic Development

John Savage
Commisioner, Oregon Public Utility Commission

Margie Schaff
Consultant, Affiliated Tribes of Northwest Indians, Economic Development Corporation

Dick Wanderscheid
Director, Electric and Telecommunications, City of Ashland

Mike Weedall
Executive Sponsor, Vice President, Energy Efficiency, Bonneville Power Administration



the Kangley-Echo Lake transmission line project went forward.

Using the Kangley-Echo Lake study as a template, TBL prepared analyses for the Olympic Peninsula and Lower Valley in Wyoming. These studies help determine the technical and economic viability of a non-wires solution. The round table reviewed the analytical studies for the two projects and concluded that non-wires solutions should be pursued further for both. But with Lower Valley, the round table said the benefits of a proposed natural gas pipeline into the valley needed to be taken into consideration as well.

Non-Wires Technology: Experts from BPA's energy efficiency organization have been brought into the non-wires initiative. They worked with the round table to educate members and explore a wide-range of technologies that hold promise as solutions to the need for additional transmission capacity. As stated earlier, these include demand response, distributed generation, conservation measures, generation siting and pricing strategies.

In addition, BPA's energy efficiency experts have been instrumental in designing and carrying out the pilot projects described later in this report.

Institutional Barriers: Institutional barriers likely represent the greatest obstacle to deploying non-wires solutions to transmission problem areas. The round table identified numerous institutional barriers that stand in the way of non-wires solutions. The top six were identified as follows:

- Lost revenues – What mechanism can be created to allow a utility to benefit from using a non-wires option if it reduces sales/revenue?
- Lack of incentives for accurate forecasting – Is there a tendency for utilities to make high transmission load forecasts that may lead to line construction before it is needed and make it more difficult to deploy non-wires solutions? If so, can something be done to address the situation? (Transmission is normally built to meet the highest plausible forecast peak demand.)
- Lack of transparency in transmission planning – How can transmission planning become less reactive and more open to developing opportunities to deploy non-wires solutions?
- Inaccurate price signals for energy and transmission – If end-use customers paid the "real" rather than an "averaged" price for service at all times, would they be induced to adjust consumption?

- Reliability of non-wires solutions – What can be done to increase understanding about the reliability of measures used to defer transmission?
- Funding and implementation – Since non-wires solutions for transmission can provide benefits to all functions within the delivery system – generation, transmission and distribution – who should pay and who should implement measures?

The round table focused its efforts in 2003 and 2004 on finding ways to resolve these issues. One objective the round table expressed is to foster partnerships that would allow for capturing all of the benefits that reduced load on the transmission grid would bring about. Members came up with possible solutions and identified questions that need further study. They also recommended pilot projects to test and gain experience with what works and what does not in addressing certain institutional barriers.

In order to achieve a comprehensive resolution to some of these barriers, the round table recognized that participation of all utilities that serve any targeted congested area may be required and perhaps even regional BPA transmission customers, may be necessary to pay for these investments.

Round table subcommittees produced work papers on screening criteria, pilot programs, cost tests, detailed studies, lost revenues, incentives for better load forecasting, transparency in the transmission planning process, better price signals, reliability of non-wires solutions and who funds/who pays. (Round table papers and study materials are posted on the BPA Web site; the address is listed at the end of this report.)

The round table met quarterly in fiscal years 2003 and 2004. At its last meeting in 2004, members set out several initiatives for 2005, including:

- Complete a review of the 2004 pilot projects;
- Reach out to potential partners in non-wires pilots;
- Seek members from interests not currently represented on the round table;
- Develop and implement outreach activities for communities and customers;
- Identify and conduct new pilots in partnership with utilities.

Non-Wires Accomplishments

BPA set out a list of goals for its Non-Wires Solutions initiative in 2003 and 2004. With the help of the round table members and others, BPA met its goals in both years. For 2005, BPA intends to complete its evaluation of the fiscal year 2004 pilot projects and expand its efforts with pilots, apply non-wires solutions screening criteria to capital transmission projects of $2 million or more, continue implementing the institutional barriers action plan, support a timely EIS process and analysis for the Olympic Peninsula and Lower Valley and continue the round table.

The round table will also continue to work on several institutional barriers, including pricing, load forecasting and reliability of non-wires solutions.

Reliability of Non-Wires Solutions

In addition, with electric reliability in the national spotlight following the Aug. 14, 2003, East Coast blackout and possible mandatory reliability standards at a federal level, the challenges of making non-wires solutions competitive with transmission should not be underestimated. Given the potential reliability risk a retail utility faces in a transmission constrained area targeted for non-wires alternatives, any portfolio of non-wires measures put in place to defer a transmission project should provide the same reliability as the transmission fix.

Non-Wires Pilots: Testing and Building Confidence

BPA is sponsoring pilot projects to test technologies, resolve institutional barriers and build confidence in using non-wires solutions. In 2004, the Non-Wires Solutions initiative undertook four pilot projects.

The Olympic Peninsula has received particular attention since it is an environmentally sensitive area with increasing demand for electricity and limited transmission capacity. Two of the pilots are on the peninsula, where a significant transmission construction project, including a new 20-mile 230-kV line, is being contemplated.

Aggregated Distributed Generation: BPA is testing the feasibility of using small-scale power generation technology, such as the backup generators at hospitals and local-government sites, to defer construction of a new transmission line on the Olympic Peninsula. An energy services company, Celerity Energy, is working with BPA to aggregate about 5 MW of distributed generation on the peninsula.

Celerity installed automatic controls to dispatch generation from this resource on an emergency basis when it is needed to support the transmission system. Celerity identified a dozen potential generators and hopes to put agreements in place with the owners to become part of the pilot project. BPA plans to run a test this winter, once the agreements are in place, to see if augmenting generation locally can meet peak demand on the transmission system.

All pilots involving generation raised some concerns among round table members about air quality impacts if diesel generators are used on more than a very limited basis.

Demand-Reduction: A demand-reduction pilot carried out in March 2004 provided encouraging results for easing congestion on transmission lines serving the Olympic Peninsula. During the four days of tests, BPA simulated a severe weather event and asked participants – in this case, a utility and three large electricity users – to reduce their need for transmission services. BPA posted the hourly rate it would pay for each megawatt of reduction.

BPA was able to purchase an average of 22 MW of demand reduction during each hour of the test. The power is equivalent to more than one-year's load growth

on the peninsula. BPA plans to run the pilot again this winter at peak-use time periods to see what demand reduction is possible.

Load Reduction and Micro-turbine Generation: BPA has undertaken two pilot projects at Pacific Northwest National Laboratory (PNNL) facilities in Richland, Wash. The pilots are Internet-based load-control projects. One involves load reduction in commercial buildings and the other entails remote operation of a micro-turbine at the PNNL site.

Load in the commercial buildings will be reduced for one-hour periods to find the maximum possible reduction in a super-peak period on the transmission system and the micro-turbine will be remotely controlled to reduce consumption during peak periods at the facilities. Both pilots are controlled from BPA in Portland via the Internet.

Direct-Load Control: A pilot project in Ashland, Ore., will test the feasibility of direct-load control and its potential to reduce demand charges and contribute to transmission line deferrals. The load-control pilot, which includes both commercial and residential customers, links customers and BPA via the Internet.

The connection allows BPA to remotely monitor and shift electricity use to periods when demand is lower. This is accomplished by remotely curtailing "discretionary" electricity uses, such as resetting thermostats and air conditioning units. The shifts are intended to reduce peak loads on the transmission system. The equipment needed to carry out the remote operations is being installed, and the city of Ashland is continuing to recruit participants.

BPA will also be reviewing a study that is due out soon on the feasibility of a distributed generation pilot project near Twin Falls, Idaho that would use biowaste from dairy herds. Among other objectives, the study is looking into the potential benefits to the electricity transmission and distribution system from locating a biowaste generator in southern Idaho.

Future Pilots: In addition to the 2004 pilots described above, BPA solicited proposals for projects to carry out in 2005 and 2006. A request went out in June to about 135 companies that provide advanced metering, energy management services, building automation and grid monitors and controls. BPA is looking for pilot projects that can help determine whether non-wires options can be used as viable alternatives to transmission line construction.

BPA, with the assistance of Non-Wires Solutions Round Table members, is currently evaluating over 25 proposals received by the Sept. 3, 2004 deadline. The agency has budgeted $1 million for pilots in each of fiscal years 2005 and 2006.

A System-wide Transmission Plan and EIS

In June, TBL updated its transmission plan, which includes system additions, replacements and upgrades. The plan, which assures compliance with regional

and national reliability standards, is revised every two years to reflect the latest information. It was reviewed in a public process called "Programs in Review" in preparation for the transmission rate case. In addition, all major projects receive technical and economic review in the Northwest Power Pool's Transmission Planning Committee. The current plan includes evaluating non-wires solutions in the transmission planning process.

Since 2003, TBL has been developing a policy EIS that would incorporate non-wires solutions. That work will be integrated with an extensive update of BPA's Business Plan EIS, which is due to be completed in August 2005. TBL expects this updated EIS will include much of the environmental analysis needed to implement non-wires solutions to meet transmission needs.

Coordination and Outreach

BPA has made a sustained effort to bring the region into its Non-Wires Solutions initiative. The round table has been a major element in that outreach. TBL has also published a newsletter, the "Non-Wires Solutions Update," and been a sponsor of a Regional Transmission Load Forecasting Workshop in June 2004 and the "Energizing the Northwest Today and Tomorrow" conference in September 2004.

BPA views the support of the region as crucial for non-wires solutions to be successfully implemented. In addition to soliciting the participation of utilities and other transmission providers on the round table, BPA is working with the Northwest Transmission Assessment Committee, a subgroup of the Northwest Power Pool's Transmission Planning Committee, to increase coordination and transparency in regional transmission planning.

For More Information

Extensive information about BPA's Non-Wires Solutions initiative has been posted on the TBL Web site at: *http://www.transmission.bpa.gov*. Information about the Non-Wires Solutions Round Table, as well as papers on issues and policies related to non-wires solutions and the non-wires pilot projects, are on the Web site. To order additional copies of this report, call BPA's Public Information Center at (503) 230-7334 in Portland, or outside Portland at 1-800-622-4520.